

# Designing to Learn

A Focus on  
Design in  
Project-Based  
Learning

By Diane McGrath

**Subject:** Technology-infused PBL

**Audience:** Teachers, teacher educators

**Grade Level:** K–12

**Technology:** Internet/Web

**Standards:** NETS•S 3–5; NETS•T II ([www.iste.org/standards](http://www.iste.org/standards))

In this column, we follow a thread from last month's column on artifacts and understanding (*L&L*, 30[5], pp. 22–27). We will view project-based learning (PBL) as a design and communication process based on the learners' research. Design is an essential part of PBL, for both teachers setting up a project and learners carrying out a project.

Design—hmm, what is design anyway? The dictionary has a number of definitions that have to do with plans and purposes. Perkins (1986) calls it a structure with a purpose, model cases, and one or more means of evaluation. Ehrmann and Balestri (1992) encourage teachers to set up their classrooms as design “studios” in which learners use sophisticated technologies to assist in research and construction of communicative artifacts.

These meanings suggest that the word *design* is a good fit for what learners are doing when they construct artifacts to better understand a subject and then to communicate to an audience what they have learned. The notion of design in this context also implies some features of the process that we should not ignore as we look at PBL:

1. *Design skills*: What skills are needed for learners and teachers to develop a project?
2. *Planning*: What kinds of scaffolds to planning are available or can be devised?
3. *Audience*: What is the role and purpose of an audience for the project?
4. *Standards*: How do we engage students in setting high standards for project work?

## Design Skills

The skills for designing learning environments are complex and sophisticated, but they are not as unfamiliar or overwhelming as they might seem. To design an artifact (e.g., a constructed object or multimedia presentation) that represents learning, students (and

teachers) will need to develop the following skills and abilities:

- research
- organization, project, and time management
- represent understanding (in the form of an artifact)
- presentation
- self-evaluation
- accepting others' evaluations
- revision

Because these skills and abilities may be new to the teacher and students, developing them must be part of the project learning process.

When you stop to think about it, we have plenty of models of how the design process can and does work in other school activities. In sports, coaches and players work together to make sure "plays" are well understood and practiced before a game. In music, individuals rehearse their parts at home, work with groups of musicians playing the same part (e.g., all the first violins), and come together as an entire orchestra or band for rehearsals in which the various parts are put together, typically ending with a dress rehearsal with a few people in the audience. In shop, students learn to use tools on small projects and then build, often collaboratively, a large product, discussing the details of measurements, tools, and materials. In all of these and other design processes, it is important that students learn about the tools, about practicing until they understand and get good at something, and about the importance of managing one's own time and practice or learning, studying models of what the final goal might look (or sound) like, and getting feedback and revising their work.

In addition to available models of design skills involved in more performance-like courses, we as teachers also know about research, about how to find out things we want or need to know and ways to solve problems. We don't often talk about it, but if we don't know exactly where to go

for resources, we usually know whom to ask or how to find out. We can model these skills for the students by being another (more advanced) learner in the design classroom.

### Planning

Planning is one of those things about which our students are notoriously unconcerned and unskilled. When learners are supposed to hand in outlines of an essay, they typically write the essay first and then make an outline from it. Planning something ahead of time seems like such a drag. Most of them (and many of us) would rather dig in and try something than plan ahead. After all, planning is so time consuming and difficult. It takes a good deal of experience with putting in extra hours *undoing* a project before we learn to appreciate planning.

One of the things we can do as teachers is help our students learn to appreciate and engage in planning by giving them some tools that really do help them. Often in a long-term project, students lose track of what they are doing, or someone is absent from the group, and either that student has trouble figuring out what went on or the group has trouble making progress without some pieces only the missing student has. Notebooks that are updated each day and left in the classroom can help with that problem. Below I describe some tools for planning that help learners articulate their thinking (Barron et al., 1998).

The Designer's Notebook templates shown in Figure 1 were used in a high school science class in which students were designing hypertext structures to represent their understanding of their research on major concepts about water (McGrath, Sylvester & Chen, 1999). Students filled out these notebook pages each day of project work. The pages could be filled out on paper or set up in a word processing program. That way, depending on the form of the finished artifact, notes could be cut and

pasted from the Designer's Notebook into the final presentation. Or the notes could be e-mailed home to help students continue their work after school, to their group members to share their understandings, or to the teacher to solicit comments.

Another type of tool, the project checklist, is one of several useful PBL tools that have been designed and made available by the High Plains Regional Technology Consortium (HPR\*TEC). Sample project checklists are given for different grade levels and different subject matters, and teachers are encouraged to have students participate in the design of the checklist. (*Editor's note:* Find HPR\*TEC's checklists and other URLs in Resources on p. 57.) The lists are self-assessment tools that remind students of the various pieces of a project. For example, for middle school science, they offer a series of checklists on background research, cooperative work, experimental work, lab safety, lab work, and relating concepts. The background research checklist, as an example, has 11 things for students to ask themselves about their sources and the reliability of those sources.

A CD-ROM from WestEd on Project-Based Learning and Multimedia (PBL + MM) also has planning tools for both teachers and students, and demonstrates the use of planning tools with the students in the accompanying video. Some of the tools available are a calendar, goals, ways of setting up collaboration, and rating sheets.

### Audience

I like to think of audience as having two roles, one in the design stage of the project and one in the final evaluation stage. When teachers use audience in these two roles, they often use two separate audiences. The idea of an outside audience is one feature of PBL that really sets it apart from traditional learning, where the only audience is generally the teacher, with occasional performances in front of the class.

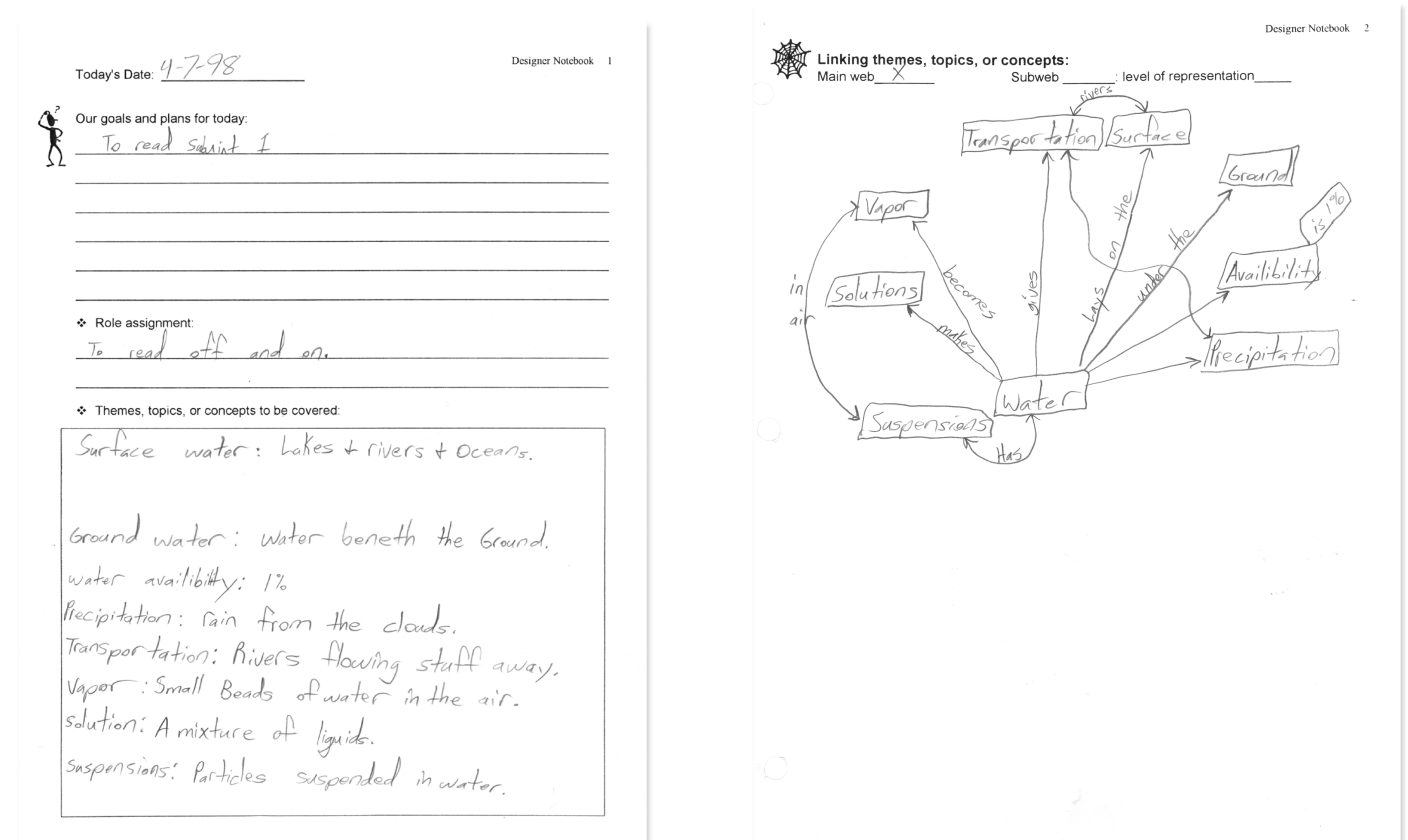


Figure 1. Completed Designer's Notebook planning templates (McGrath, Sylvester, & Chen, 1999).

It is perhaps easier to see the role of an outside audience in the final presentation of the artifact, as this occurs regularly in performances or in judging objects in a contest or fair. In PBL, we are encouraged to have an outside audience for all projects, whether it be another classroom of students; anyone who wants to see it (as in a Web site creation); parents attending a parent night; the school board; or members of the local community, state group, or professional organization attending a presentation. Sometimes projects are for just one person, such as when a group of students constructs a video or multimedia project to help another student learn to deal better with a problem. Sometimes the audience is there to appreciate (e.g., parents), and sometimes to judge (e.g., other teachers, researchers, or experts are brought in to evaluate the projects or ask questions of the students who designed them).

There is a good deal of evidence that students work harder and polish up

their projects to a higher degree when there is an audience and a deadline for that visit from the audience. (McGrath et al., 1995/1997; Penuel, Korbak, Yarnall, & Pacpaco, 2001)

But there is another role for audience, and that role is in what we might think of as formative evaluation of the project. Because projects take place over an extended period of time and have a great deal riding on them (in terms of grades, understanding, and time and talent invested), it is a good idea to evaluate understanding, plans, and beginning stages of artifact construction often as the project goes along. For this purpose, an audience is also extremely useful. If the project is an object that will be constructed, ask outside people (e.g., students, teachers, parents, or experts) to take a look at the plans and ask questions and make suggestions. It can be something like the alpha and beta testing in software development or the process that architects use in designing a new building. Have other groups

in the same classroom also make suggestions. Because presumably they are all grappling with different aspects of the same subject matter and with project design, they may have very good ideas. Teachers will have to set the tone that the goal of this feedback is to make everyone's project as good as it can be, not to tear people down.

If the project is a Web site or a multimedia or hypermedia project, then the storyboard or diagram or other type of plan may be shown to other students, to students or adults not in the class, or to experts to ask questions and give feedback. This process should encourage revision in order to communicate effectively with the audience and to make one's ideas clearer and more accurate. And it should be done often during the long design process. This spreads around the evaluative audience so evaluation and feedback is not the sole responsibility of the teacher. Barron et al. (1998) list frequent opportunities for formative self-assessment and revi-



Designer Notebook 3

❖ What we found hard/easy about our project today? Did we achieve what we set out to? How well did our strategies work?

*The reading was hard, yes, fine.*

❖ Changes we made today and why we made these changes:

*We got something done. To get a grade.*

❖ Plans and ideas for next time: What would we do differently next time? Why? What do we want to find out about now? Why?

*Computer work. How to work the computer.*

sion as one of the important principles for doing projects with understanding.

### Standards

One issue often raises concern in PBL, particularly when students are designing multimedia projects, and that is the possibility and even likelihood that students will be carried away by the technological possibilities and ignore the subject matter. It is important that the students are really being learners in this design process, rather than just getting caught up in the fancy stuff—the colors, the audio, the cuteness.

One way to help learners focus on learning is the formative use of audience, as discussed above. Another way is to use project-planning tools that ask learners to document their goals and that serve as a reminder of what is important. Still another solution is to view the classroom as a design studio, as mentioned at the beginning of this article. In a design studio, students don't just design one project, they design

many projects. Over time, they learn what is important in the design process, and the bells and whistles become “old hat.” In a study of sixth and seventh graders over a series of projects during a two-year period, student standards “evolved from eye-catching presentation to clarity of communication and consideration of audience” (Erickson & Lehrer, 1998, p. 351). This study provides evidence of the value of project-based learning as a regular part of learning rather than a one-time event.

Using PBL as a regular part of a learning environment leads us to the subject of the next column: developing a community of learners.

### Resources

In addition to Diane McGrath's PBL Web site (<http://coe.ksu.edu/PBL>), which expands on resources mentioned in the PBL columns with annotations and further links, you may also find the following resources useful:

Artemis (GOKNOW's tool for online inquiry): [www.goknow.com/artemis1.htm](http://www.goknow.com/artemis1.htm)  
GRITS (Great Resources for Integrating Tech-

nology in Schools): [www.gritsonline.org/index.html](http://www.gritsonline.org/index.html)

Project-Based Learning (from HPR\*TEC's Web for Teachers site): [www.4teachers.org/projectbased](http://www.4teachers.org/projectbased)

WestEd's PBL with Multimedia CD-ROM (PBL + MM), \$25: [www.wested.org/cs/view/view/rs/608](http://www.wested.org/cs/view/view/rs/608)

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